FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

Division of Water Resource Management, Bureau of Watershed Management

Southwest DISTRICT • Tampa Bay Tributaries BASIN

TMDL Report

Total Coliform TMDL for the Hillsborough River (WBID 1443D)

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Acknowledgments

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Web sites

Florida Department of Environmental Protection, Bureau of Watershed Management

TMDL Program

http://www.dep.state.fl.us/water/tmdl/index.htm

Identification of Impaired Surface Waters Rule

http://www.dep.state.fl.us/water/tmdl/docs/AmendedIWR.pdf

STORET Program

http://www.dep.state.fl.us/water/storet/index.htm

2002 305(b) Report

http://www.dep.state.fl.us/water/docs/2002_305b.pdf

Criteria for Surface Water Quality Classifications

http://www.dep.state.fl.us/legal/rules/shared/62-302t.pdf

Basin Status Report for the Hillsborough River Basin

http://www.dep.state.fl.us/water/tmdl/stat_rep.htm

Water Quality Assessment Report for the Hillsborough River Basin

http://www.dep.state.fl.us/water/tmdl/stat_rep.htm

Allocation Technical Advisory Committee (ATAC) Report

http://www.dep.state.fl.us/water/tmdl/docs/Allocation.pdf

U.S. Environmental Protection Agency

Region 4: Total Maximum Daily Loads in Florida

http://www.epa.gov/region4/water/tmdl/florida/.

National STORET Program

http://www.epa.gov/storet/

Chapter 1: INTRODUCTION

1.1 Purpose of Report

This report presents the Total Maximum Daily Load (TMDL) for total coliform for a segment of the Hillsborough River in the Tampa Bay Tributaries Basin. The river segment was verified as impaired for total coliform, and was included on the Verified List of impaired waters for the Tampa Bay Tributaries Basin that was adopted by Secretarial Order on May 27, 2004. The Hillsborough River, which is located in the Hillsborough River Planning Unit, extends over parts of three counties, including much of the northeastern quarter of Hillsborough County, a large area of central Pasco County, and a small portion of northwestern Polk County. It is bounded to the north by the Withlacoochee River watershed, to the east by the Peace River watershed, to the south by the Alafia River watershed, and to the west by the North Coastal and Tampa Bay watersheds (Southwest Florida Water Management District [SWFWMD], 1999) **(Figure 1.1).** The TMDL establishes the allowable loadings to WBID 1443D of the Hillsborough River that would restore the waterbody so it meets the applicable water quality criterion for total coliform.

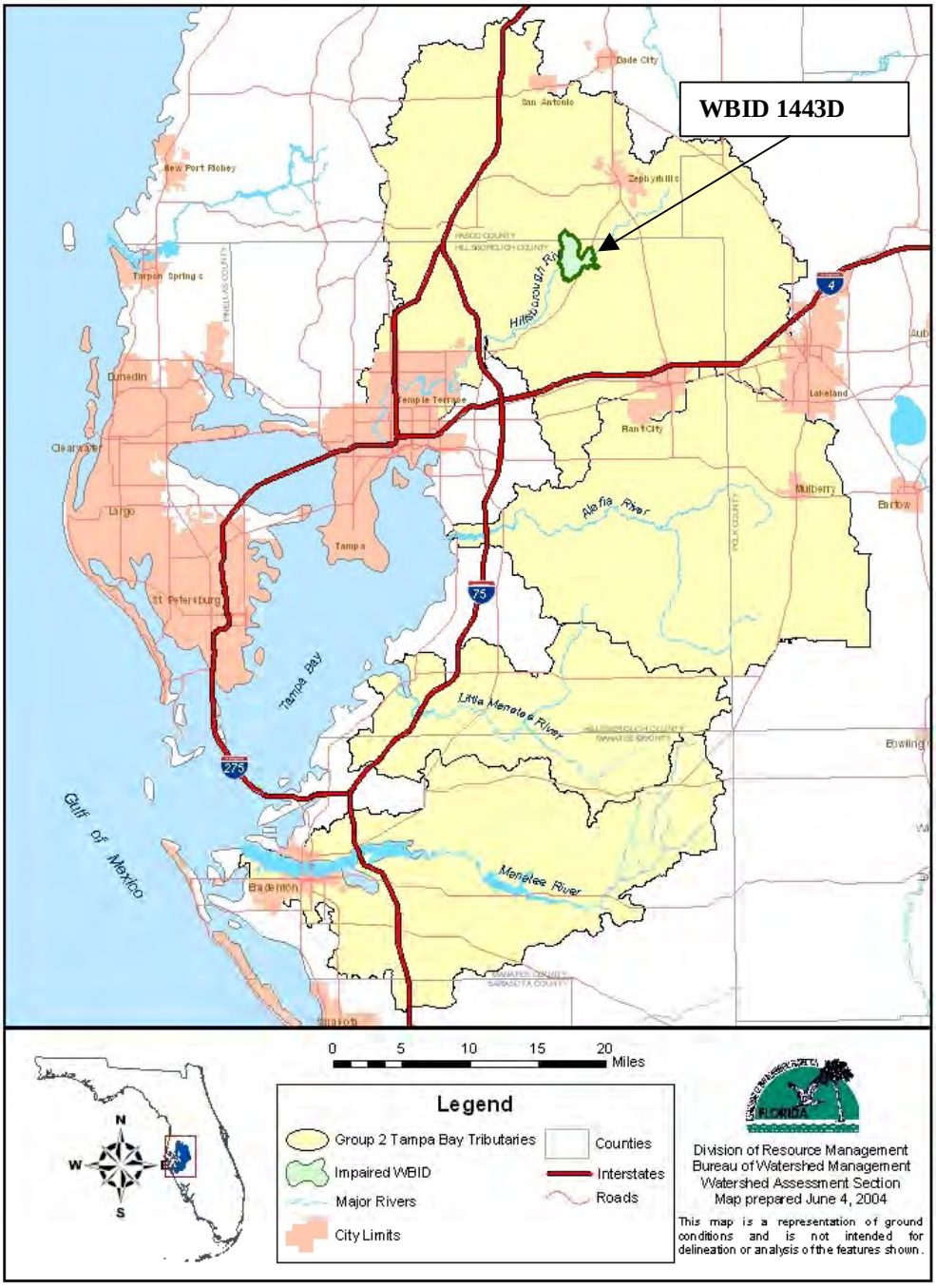
1.2 Identification of Waterbody

The Hillsborough River Basin **(Figure 1.1)** begins east-northeast of Zephyrhills in southeastern Pasco and northwestern Polk Counties. Its headwaters originate in the southwestern portion of the Green Swamp, where it also receives overflow from the Withlacoochee River. The river channel is not clearly defined until the river leaves the swamp. From there, it flows southwesterly 54 miles to upper Hillsborough Bay and drains more than 690 square miles. Perennially flowing tributaries to the Hillsborough River are Big Ditch and Flint Creek. Intermittent streams are Indian Creek, New River, Two Hole Branch, Basset Branch, Hollomans Branch, Clay Gully, Trout Creek, Blackwater Creek, and Cypress Creek.

High floodwaters are diverted from the Hillsborough River at the confluence of Trout Creek and upstream of the Tampa Reservoir Dam through the Tampa Bypass Canal to McKay Bay. Channelization has extended Sixmile Creek west and north to intersect the Hillsborough River at two points, the confluence of Trout Creek and near the midpoint of the Tampa Reservoir, which supplies drinking water to the city of Tampa. The modified Sixmile Creek was then renamed the Tampa Bypass Canal, which comprises two canals. The Harney Canal (C-136) runs from the Tampa Reservoir to join the second and longer canal, C-135, which connects the Hillsborough River at Trout Creek and Palm River. Both canals control flooding in the city of Tampa.

Urban and built-up areas dominate the landscape in the southern quarter of the planning unit, which includes the urban and suburban areas of Tampa, Plant City, and Lakeland. In the upper half of the planning unit (to the north), urban and suburban areas appear as an east-west band encompassing Zephyrhills, Wesley Chapel, and Land O' Lakes. Together, urban and built-up lands comprise 25 percent of the total area. Within the region, which is characterized by expanding population growth and land development, large areas of swamps and forested uplands remain undeveloped along portions of the Hillsborough River and its principal tributaries. Together with other undeveloped lands, natural lands (uplands and wetlands) comprise 39 percent of the planning unit.

Figure 1.1. Florida Department of Environmental Protection, Southwest District Basin Groups: Hillsborough River, Group 2



Throughout most of the rest of the planning unit, particularly in the upper reaches of its tributaries, land uses are primarily rangeland, pasture, and agriculture, including citrus groves and row crops. The greatest acreages of citrus are found around Land O' Lakes, in the Plant City/Dover/Seffner area south and east of Lake Thonotosassa, in the area around Lakeland, and in a wide area north of Zephyrhills. Generally, the northern and central portions of the watershed are rural, while the southern portions are mainly urban and industrial. However, suburban development radiating from major urban areas such as Tampa is spreading into rural areas.

Additional information about the river's hydrology and geology are available in the Basin Status Report for the Tampa Bay Tributaries Basin (Florida Department of Environmental Protection, 2003).

For assessment purposes, the Florida Department of Environmental Protection (the Department) has divided the Tampa Bay Tributaries Basin into water assessment polygons with a unique **w**ater**b**ody **id**entification (WBID) number for each watershed or stream reach. The Hillsborough River has been divided into WBIDs or segments and this TMDL addresses WBID 1443D **(Figure 1.1 and 1.2).**

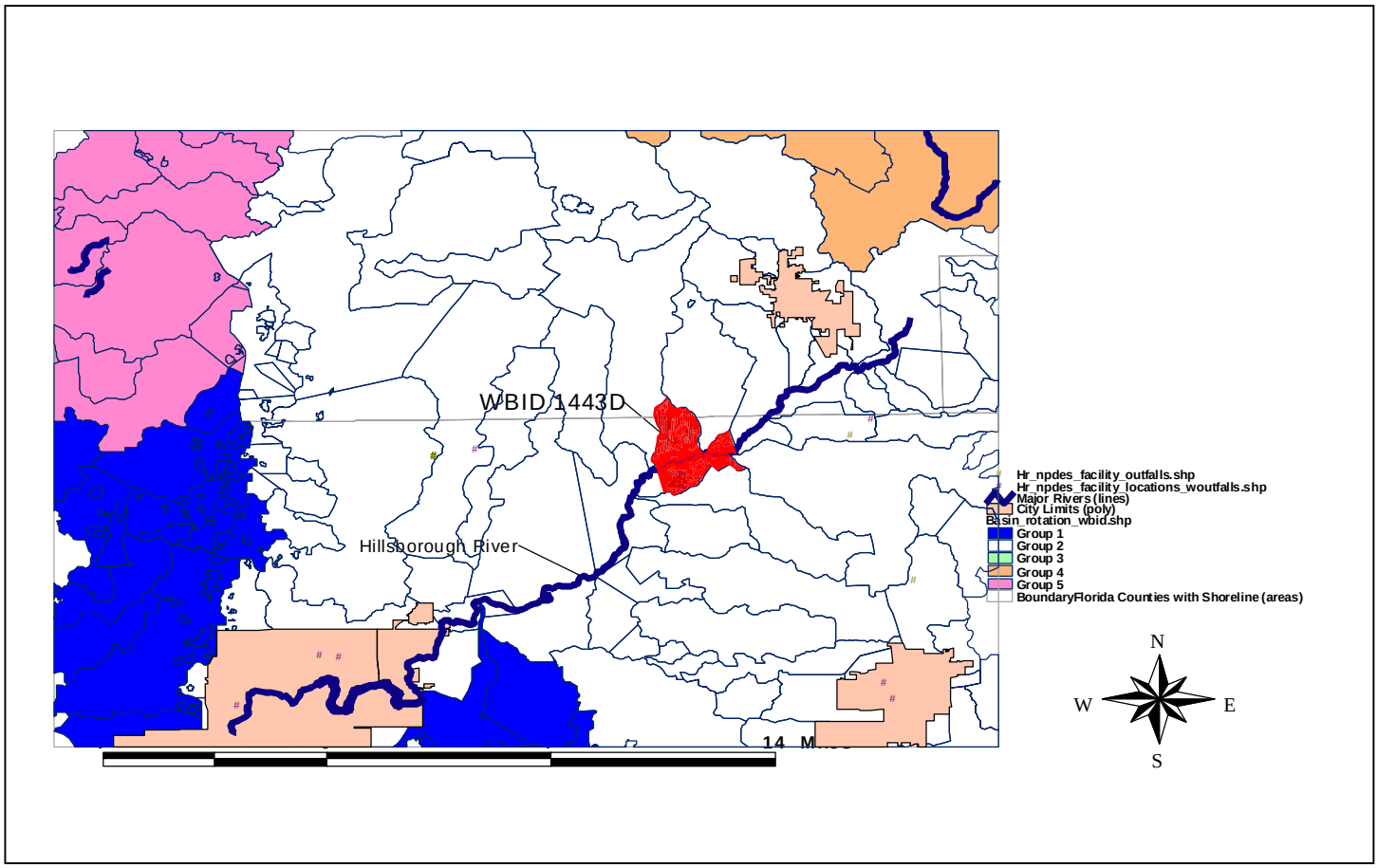
1.3 Background

This report was developed as part of the Department's watershed management approach for restoring and protecting state waters and addressing TMDL Program requirements. The watershed approach, which is implemented using a cyclical management process that rotates through the state's 52 river basins over a 5-year cycle, provides a framework for implementing the TMDL Program–related requirements of the 1972 federal Clean Water Act and the 1999 Florida Watershed Restoration Act (FWRA, Chapter 99-223, Laws of Florida).

A TMDL represents the maximum amount of a given pollutant that a waterbody can assimilate and still meet water quality standards, including its applicable water quality criteria and its designated uses. TMDLs are developed for waterbodies that are verified as not meeting their water quality standards. TMDLs provide important water quality restoration goals that will guide restoration activities.

This TMDL Report will be followed by the development and implementation of a Basin Management Action Plan, or BMAP, to reduce the amount of total coliform that caused the verified impairment of WBID 1443D of the Hillsborough River. These activities will depend heavily on the active participation of the Southwest Florida Water Management District (SWFWMD), local governments, businesses, and other stakeholders. The Department will work with these organizations and individuals to undertake or continue reductions in the discharge of pollutants and achieve the established TMDLs for impaired waterbodies.

Figure 1.2. Location of WBID 1443D and Major Geopolitical Features in the Hillsborough River Watershed



Chapter 2: DESCRIPTION OF WATER QUALITY PROBLEM

2.1 Statutory Requirements and Rulemaking History

Section 303(d) of the federal Clean Water Act requires states to submit to the U.S. Environmental Protection Agency (EPA) a list of surface waters that do not meet applicable water quality standards (impaired waters) and establish a TMDL for each pollutant source in each of these impaired waters on a schedule. The Department has developed such lists, commonly referred to as 303(d) lists, since 1992. The list of impaired waters in each basin, referred to as the Verified List, is also required by the FWRA (Subsection 403.067[4)], Florida Statutes [F.S.]).

However, the FWRA (Section 403.067, F.S.) stated that all previous Florida 303(d) lists were for planning purposes only and directed the Department to develop, and adopt by rule, a new science-based methodology to identify impaired waters. After a long rule-making process, the Environmental Regulation Commission adopted the new methodology as Chapter 62-303, Florida Administrative Code (F.A.C.) (Identification of Impaired Surface Waters Rule, or IWR), in April 2001.

2.2 Information on Verified Impairment

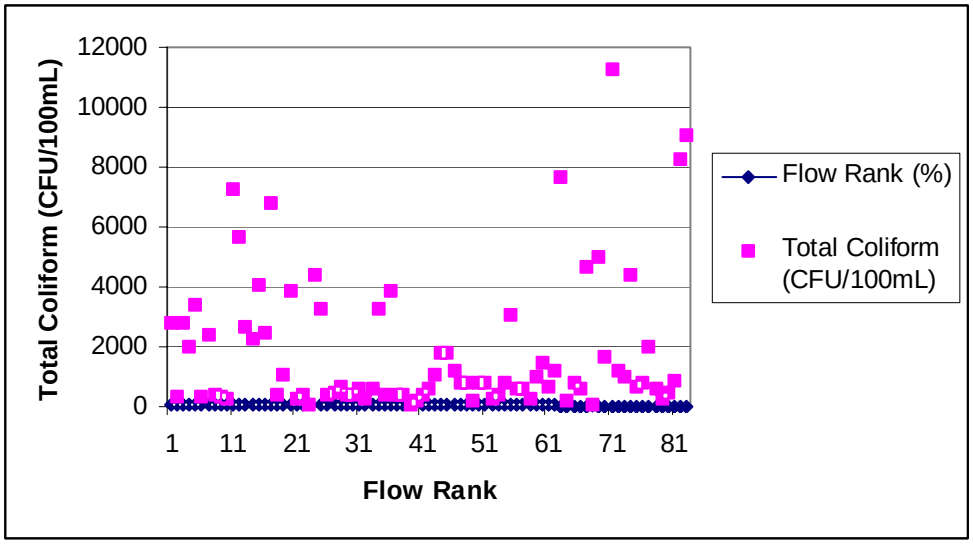
The Department used the IWR to assess water quality impairments in the Tampa Bay Tributaries Basin and has verified the impairment for total coliform in WBID 1443D. **Table 2.1** summarizes these assessment results for total coliform for the verification period for WBID 1443D.

As shown in **Table 2.1,** exceedances averaged greater than 5,000 CFU/100mL (colony-forming units per milliliter). A study for fecal coliforms contained in "Watershed Protection Techniques, Vol. 3, No. 1, April 1999" was referenced in the city of Jacksonville's Reasonable Assurance Plan, December 2003 , as indicating that wet weather fecal coliform levels over 5,000 CFU/100mL may "suggest (but do not prove) that human sources of bacteria could be present in the watershed." A second threshold for fecal coliforms is established in the Reasonable Assurance Plan at 10,000 CFU/100mL. The plan states that any WBIDs "routinely" reaching this level of fecal coliform "are most probable to contain human sources of fecal coliform." While this study is for total, not fecal, coliform, the higher total coliform values do appear during wet weather conditions **(Figure 2.1).** On the positive side, more than 99 percent of the samples are less than 10,000 CFU/100mL, and 91 percent of the results are less than 5,000 CFU/100mL; therefore, these larger concentrations are not yet routine.

Table 2.1. Summary of Total Coliform Data, January 1996–December 2001

Number of samples	Number of Exceedances	Percent Exceedances	Maximum CFU/100mL	Average Exceedance CFU/100mL	Average of All Data CFU/100mL
83	22	26%	11,300	5,023	1,875

Figure 2.1. Total Coliform vs. Flow Ranks (0 rank is lowest flow; 100 rank is highest flow)



Chapter 3. DESCRIPTION OF APPLICABLE WATER QUALITY STANDARDS AND TARGETS

3.1 Classification of the Waterbody and Criteria Applicable to the TMDL

Florida's surface waters are protected for five designated use classifications, as follows:

Class I	**Potable water supplies**
Class II	**Shellfish propagation or harvesting**
Class III	**Recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife**
Class IV	**Agricultural water supplies**
Class V	**Navigation, utility, and industrial use (there are no state waters currently in this class)**

This portion of the Hillsborough River is a Class III waterbody, with a designated use of recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife.

3.2 Applicable Water Quality Standards and Numeric Water Quality Target

Numeric water quality criteria for total coliform bacteria are expressed in terms of bacteria concentrations. The water quality criterion for the protection of Class III waters, as established by Chapter 62-302, F.A.C., states the following:

> ***Total Coliform Bacteria:***
> *The MPN[1] per 100 ml shall be less than or equal to 1,000 as a monthly average nor exceed 1,000 in more than 20 percent of the samples examined during any month; and less than or equal to 2,400 at any time.*

For total coliform, the criterion states that monthly averages shall be expressed as geometric means based on a minimum of 10 samples taken over a 30-day period.

During the development of load curves for the impaired segment (as described in subsequent sections), there were insufficient data (less than 10 samples in a given month) available to evaluate the geometric mean criterion for total coliform bacteria. Therefore, the criterion selected for the development of the TMDL was not to exceed 2,400 CFU/100mL.

[1] Most probable number.

Chapter 4: ASSESSMENT OF SOURCES

4.1 Types of Sources

An important part of the TMDL analysis is the identification of pollutant source categories, source subcategories, or individual sources of the pollutant of concern (i.e., total coliform) in a watershed and the amount of pollutant loading contributed by each of these sources. Sources are broadly classified as either "point sources" or "nonpoint sources." Historically, the term point sources has meant discharges to surface waters that typically have a continuous flow via a discernable, confined, and discrete conveyance, such as a pipe. Domestic and industrial wastewater treatment facilities (WWTFs) are examples of traditional point sources. In contrast, the term "nonpoint sources" was used to describe intermittent, rainfall driven, diffuse sources of pollution associated with everyday human activities, including runoff from urban land uses, agriculture, silviculture, and mining; discharges from failing septic systems; and atmospheric deposition.

However, the 1987 amendments to the Clean Water Act redefined certain nonpoint sources of pollution as point sources subject to regulation under the EPA's National Pollutant Discharge Elimination System (NPDES) Program. These nonpoint sources included certain urban stormwater discharges, including those from local government master drainage systems, construction sites over five acres, and a wide variety of industries (see **Appendix A** for background information on the federal and state stormwater programs).

To be consistent with Clean Water Act definitions, the term "point source" will be used to describe traditional point sources (such as domestic and industrial wastewater discharges) and stormwater systems requiring an NPDES stormwater permit when allocating pollutant load reductions required by a TMDL (see **Section 6.1**). However, the methodologies used to estimate nonpoint source loads do not distinguish between NPDES stormwater discharges and non-NPDES stormwater discharges, and as such, this source assessment section does not make any distinction between the two types of stormwater.

4.2 Potential Sources of Total Coliform in WBID 1443D of the Hillsborough River

4.2.1 Point Sources

There are no permitted wastewater treatment facilities that discharge total coliform loads either directly or indirectly into WBID 1443D of the Hillsborough River.

Municipal Separate Storm Sewer System Permittees

In the Hillsborough River watershed, about 80 percent of WBID 1443D lies within Hillsborough County and 20 percent within Pasco County. Both counties are covered under Phase 1 of the

NPDES Stormwater Program and have individual Municipal Separate Storm Sewer System (MS4) permits (Permit Numbers FLS000006 and FLS000032, for Hillsborough County and Pasco County, respectively).

4.2.2 Land Uses and Nonpoint Sources

Additional total coliform loadings to WBID 1443D are generated from nonpoint sources in the basin. Potential nonpoint sources of coliforms include loadings from surface runoff, wildlife, livestock, pets, and leaking septic tanks.

Wildlife

Wildlife deposit feces containing coliform bacteria onto land surfaces, where the bacteria can be transported during storm events to nearby streams in the watershed. Some wildlife (such as otters, beavers, raccoons, and birds) deposit their feces directly into the water. The bacterial load from naturally occurring wildlife is assumed to be background. In addition, any strategy employed to control this source would probably have a negligible impact on attaining water quality standards.

Agricultural Animals

Agricultural animals are the source of several types of coliform loading to streams in the watershed. Agricultural activities, including runoff from pastureland and cattle in streams, have the potential to impact water quality. Livestock data from the 1997 *Agricultural Census Report* for Pasco and Hillsborough County are listed in **Table 4.1** (U.S. Department of Agriculture, 1997).

Table 4.1. Livestock Distribution, by County

Livestock Distribution	Pasco County	Hillsborough County
Cattle/Calves	41,448	62,328
Milk Cows	5,150	4,463
Hogs/Pigs	3,620	3,567
Poultry Layers > 13 weeks	(D)	1,409,342
Poultry Broilers	(D)	(D)
Sheep/Lambs	72	285
Horses	1,116	2,754

(D) – Data withheld to avoid disclosing data for individual farms.

Land Uses

The spatial distribution and acreage of different land use categories were identified using the 1999 land use coverage (scale 1:40,000) contained in the Department's geographic information

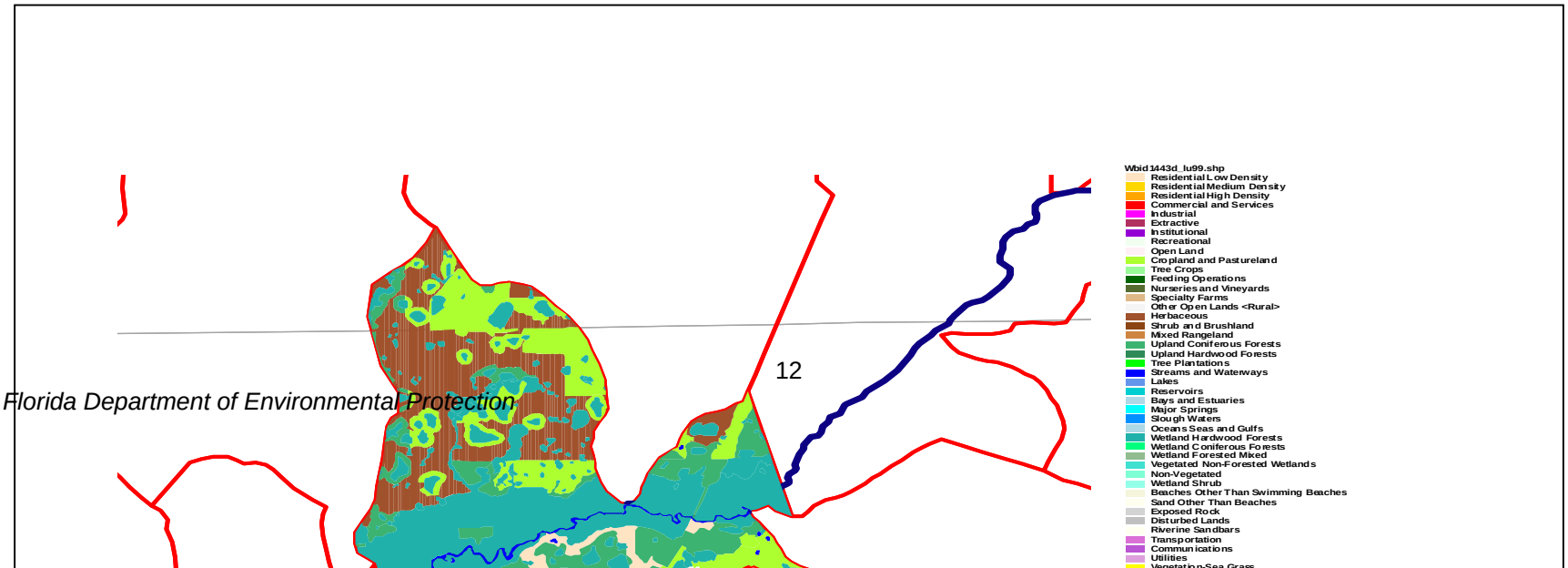
system (GIS) library. Land use categories in the watershed were aggregated using the simplified Level 1 codes tabulated in **Table 4.2. Figure 4.1** shows the acreage of the principal land uses in the watershed.

Water and wetlands make up about 38.6 percent of the WBID area. Rangeland is the next largest land use, making up 26 percent of the area, while agriculture comprises about 16.5 percent, and forest/rural open, approximately 15.7 percent. Urban and residential land uses make up less than 3 percent of the WBID area. The WBID is nearly 40 percent water and wetlands and 43 percent agriculture and rangeland.

Table 4.2. Classification of Land Use Categories in WBID 1443D

Level 1	Attribute	Area (Square Meters)	Area (Acres)	Area (Square Miles)	Percentage
1000	Urban Open	309,410.2	76.4	0.1194	2.18
1100	Residential Low Density < 2 Dwelling Units	46,291.4	11.4	0.0179	0.33
1300	Residential High Density	8,450.1	2.1	0.0033	0.06
2000	Agriculture	2,330,186.9	575.6	0.8990	16.45
3000	Rangeland	3,775,644.8	932.6	1.4567	26.65
4000	Forest/Rural Open	2,224,900.1	549.6	0.8584	15.71
5000	Water	144,964.3	35.8	0.0559	1.02
6000	Wetlands	5,326,469.1	1,315.6	2.0550	37.60
	TOTAL	**14,166,316.9**	**3,499.1**	**5.4656**	**100.00**

Figure 4.1. Principal Land Uses in WBID 1443D



Population

According to the U.S Census Bureau, the population density in and around WBID 1443D in the year 2000 was at or less than 405 people per square mile (10 person/mi^2 is the minimum used by the Census Bureau). The Bureau reports that, in Hillsborough County, which includes most of (but is not exclusive to) WBID 1443D, the total population for 2000 was 998,948, with 425,962 housing units. For all of Pasco County, which includes some of WBID 1443D, the Census Bureau reports a population of 344,765, with 173,717 housing units. Some of the Hillsborough River Basin is in Polk County. The Bureau reports that in Polk County, the total population is 483,924, with 226,376 housing units.

Septic Tanks

The following information was obtained from the Florida Department of Health Web site at http://www.doh.state.fl.us/environment/OSTDS/statistics/ostdsstatistics.htm. Data for septic tanks are based on the 1970 census results, with year-by-year additions based on new septic tank construction. The data do not reflect septic tanks that may have been removed. The number of residences using septic tanks in Hillsborough, Pasco, and Polk Counties is as follows:

- Hillsborough County has a cumulative registry of 100,483 septic tanks. With 425,962 households in the county, this means that approximately 76 percent of the residences in the county are connected to wastewater treatment plants, with the rest (24 percent) utilizing septic tanks.
- Pasco County has registered 66,583 septic tanks. With 173,717 households, this means that approximately 62 percent of the residences in the county are connected to wastewater treatment plants, with the rest (38 percent) utilizing septic tanks.
- Polk County has registered 110,200 septic tanks. With 226,376 households, this means that approximately 51 percent of the residences in the county are connected to wastewater treatment plants, with the rest (49 percent) utilizing septic tanks.

Chapter 5: DETERMINATION OF ASSIMILATIVE CAPACITY

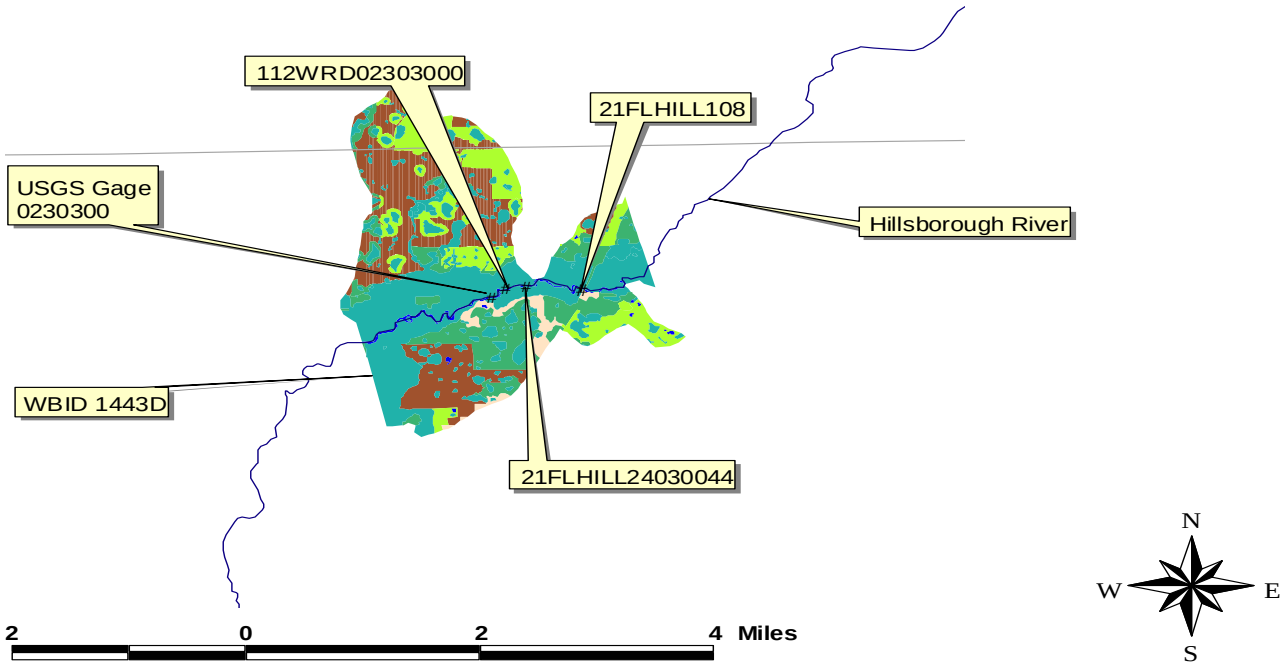
5.1 Determination of Loading Capacity

The methodology used for this TMDL is the "load duration curve." Also known as the "Kansas Approach" because it was developed by the state of Kansas, this method has been well documented in the literature, with improved modifications used by EPA Region 4.

5.1.1 Data Used in the Determination of the TMDL

There are three sampling stations in WBID 1443D that have long-term historical observations **(Figure 5.1).** The primary data collector of historical data is the Hillsborough County EPC, which maintained two routine sampling sites on the river, one at the U.S. 301 Bridge (21FLHILL24030004; name changed to 21FLHILL108 in January 1999) and a second site, 21FLHILL24030044, near Zephyrhills. The third site, 112WRD02303000, is also near Zephyrhills but is maintained by the U.S. Geological Survey (USGS). The data used for this assessment site came from samples taken on a monthly basis from January 1996 through December 2001. **Figure 5.1** shows the locations of these sites, and **Table 2.1** provides a brief statistical overview of the observed data at these sites. Flow data for the river were available from USGS Gage 02303000. Data for the gage were obtained from the EPA, and the flow duration curve for USGS Gage 02303000 is shown in **Figure 5.2.**

Figure 5.1. Historical Monitoring Sites in WBID 1443D



5.1.2 TMDL Development Process

The Department divided the range of flows from the USGS flow gage into "flow zones." The concept of zones is adopted from Dr. Bruce Cleland (Cleland, August 15, 2002). The purpose of the zones is to demarcate hydrologic conditions between drought and peak flood into flow ranges such as low, dry, average, moist, and high.

Expressing the flows in terms of frequency of recurrence (duration) allows a linkage of exceedances of the criterion to specific flow intervals and durations. For example, if all of the exceedances occurred during low-flow conditions, point sources of the pollutant should be suspected. Conversely, if all the exceedances came during higher flow periods, then nonpoint sources of pollution should be suspected. Following Dr. Cleland's approach (Cleland, September 2003), the Department has selected the following flow zones: "High" (0 – 10 percentile flow), "Moist" (11 – 40), "Mid-Range" (41 – 60), "Dry" (61 – 90), and "Low" (91 – 100). **Figure 5.2** shows the flow duration curve for USGS Gage 02303000.
Using the flows from the flow duration curve, a load duration curve or allowable load curve for total coliform **(Figure 5.3)** was calculated using the following equation:

(observed flow) x (conversion factor) x (state criterion) = ([total coliform quantity]/day or daily load) (1)

Using Equation 1 (above), a table was calculated **(Table 5.1),** substituting the observed data for the state criterion value. Total coliform observations were then plotted, noting where the samples are in relation to the allowable load curve (i.e., above or below the curve). Those above the curve **(Figure 5.3)** are noted as exceedances to the state criterion.

Figure 5.2. Flow Duration Curve for USGS Gage 02303000

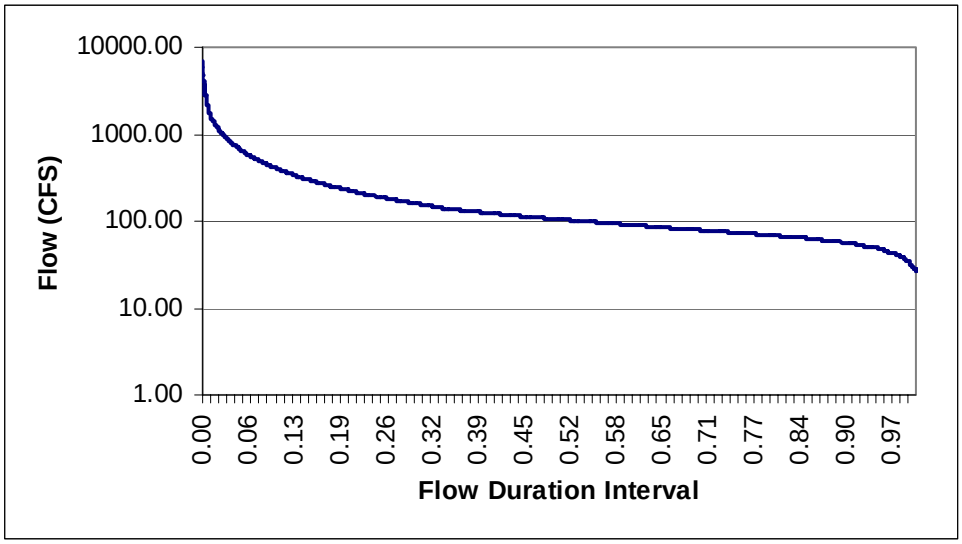


Figure 5.3. Total Coliform Observations and Load Duration Curve

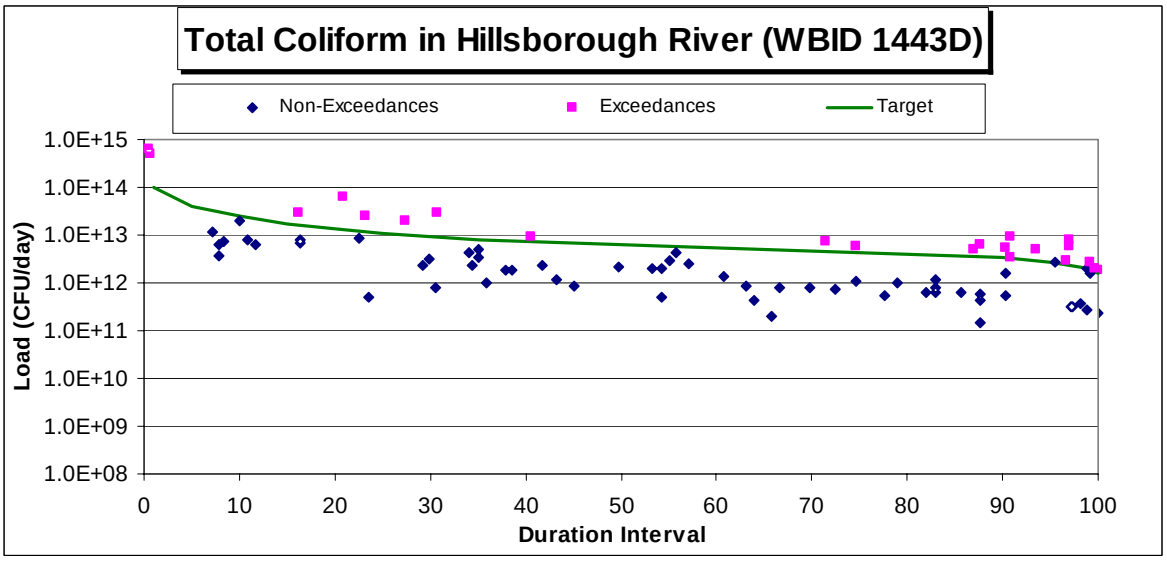


Table 5.1. Observed Data for Calculating Exceedances to the State Criterion for Hillsborough River, WBID 1443D

Total Coliform Station	Sample Date	Sample Time	Flow (cubic feet per second [cfs])*	Flow Rank	Flow Rank (%)	Total Coliform (CFU/100mL)*	Total Coliform Load (CFU/day)
21FLHILL24030004	1/23/1996	1350	164.000	29.2%	29.2	600	2.41E+12
21FLHILL24030004	2/20/1996	1427	157.000	30.5%	30.5	200	7.68E+11
21FLHILL24030004	3/19/1996	1400	279.000	16.2%	16.2	4400	3.00E+13
21FLHILL24030004	4/16/1996	1350	200.000	23.5%	23.5	100	4.89E+11
21FLHILL24030004	5/14/1996	1425	99.000	54.3%	54.3	800	1.94E+12
21FLHILL24030004	5/14/1996	1425	99.000	54.3%	54.3	800	1.94E+12
21FLHILL24030004	6/18/1996	1420	97.000	55.7%	55.7	1800	4.27E+12
21FLHILL24030004	6/18/1996	1420	97.000	55.7%	55.7	1800	4.27E+12
21FLHILL24030004	7/16/1996	1410	278.000	16.3%	16.3	1200	8.16E+12
21FLA 24030044	8/6/1996	1100	130.000	37.9%	37.9	580	1.84E+12
21FLHILL24030004	8/20/1996	1430	128.000	38.6%	38.6	600	1.88E+12
21FLA 24030044	9/6/1996	1100	74.000	74.6%	74.6	580	1.05E+12
21FLHILL24030004	9/24/1996	1400	209.000	22.5%	22.5	1700	8.69E+12
21FLHILL24030004	10/15/1996	1405	106.000	49.8%	49.8	800	2.07E+12
21FLHILL24030004	11/19/1996	1355	57.000	90.3%	90.3	400	5.58E+11
21FLHILL24030004	12/10/1996	1410	100.000	53.3%	53.3	800	1.96E+12
21FLHILL24030004	1/21/1997	1410	79.000	69.7%	69.7	400	7.73E+11
21FLHILL24030004	2/18/1997	1425	71.000	77.7%	77.7	300	5.21E+11
21FLHILL24030004	3/18/1997	1407	60.000	87.7%	87.7	300	4.40E+11
21FLHILL24030004	4/15/1997	1332	66.000	82.9%	82.9	500	8.07E+11
21FLHILL24030004	5/20/1997	1405	60.000	87.7%	87.7	400	5.87E+11
21FLHILL24030004	6/17/1997	1500	66.000	82.9%	82.9	700	1.13E+12
21FLHILL24030004	7/22/1997	1445	277.000	16.3%	16.3	1000	6.78E+12
21FLHILL24030004	8/19/1997	1400	367.000	11.7%	11.7	700	6.29E+12
21FLHILL24030004	9/16/1997	1340	76.000	72.4%	72.4	400	7.44E+11
21FLHILL24030004	10/14/1997	1430	160.000	29.8%	29.8	800	3.13E+12
21FLHILL24030004	11/18/1997	1445	506.000	7.8%	7.8	500	6.19E+12
21FLHILL24030004	12/9/1997	1355	535.000	7.1%	7.1	900	1.18E+13
21FLHILL24030004	1/20/1998	1325	495.000	7.9%	7.9	300	3.63E+12
21FLHILL24030004	2/17/1998	1420	2790.000	0.5%	0.5	9100	6.21E+14
21FLHILL24030004	3/17/1998	1345	484.000	8.3%	8.3	600	7.10E+12
21FLHILL24030004	4/21/1998	1442	118.000	43.2%	43.2	400	1.15E+12
21FLHILL24030004	5/19/1998	1458	83.000	66.6%	66.6	400	8.12E+11
21FLHILL24030004	6/16/1998	1325	70.000	79.0%	79	600	1.03E+12
21FLHILL24030004	7/21/1998	1355	394.000	10.8%	10.8	800	7.71E+12
21FLHILL24030004	8/25/1998	1352	135.000	35.9%	35.9	300	9.91E+11
21FLTPA 24030044	9/15/1998	1100	138.000	35.1%	35.1	980	3.31E+12
21FLHILL24030004	9/15/1998	1500	138.000	35.1%	35.1	1500	5.06E+12
21FLHILL24030004	10/20/1998	1352	140.000	34.4%	34.4	700	2.40E+12

Total Coliform Station	Sample Date	Sample Time	Flow (cubic feet per second [cfs])*	Flow Rank	Flow Rank (%)	Total Coliform (CFU/100mL)*	Total Coliform Load (CFU/day)
21FLHILL24030004	11/17/1998	1400	99.000	54.3%	54.3	200	4.84E+11
21FLHILL24030004	12/8/1998	1338	86.000	63.9%	63.9	200	4.21E+11
21FLHILL108	1/19/1999	1400	84.000	65.7%	65.7	100	2.06E+11
21FLHILL108	2/16/1999	1404	87.000	63.1%	63.1	400	8.51E+11
21FLHILL108	3/16/1999	1434	90.000	60.8%	60.8	600	1.32E+12
21FLHILL108	4/20/1999	1350	60.000	87.7%	87.7	100	1.47E+11
21FLHILL108	5/18/1999	1350	63.000	85.6%	85.6	400	6.17E+11
21FLHILL108	6/15/1999	1355	114.000	45.1%	45.1	300	8.37E+11
21FLHILL108	7/20/1999	1404	95.000	57.1%	57.1	1100	2.56E+12
21FLHILL108	8/17/1999	1555	98.000	55.1%	55.1	1200	2.88E+12
21FLHILL108	9/22/1999	1506	141.000	34.1%	34.1	1200	4.14E+12
21FLHILL108	10/12/1999	1436	121.000	41.7%	41.7	800	2.37E+12
21FLHILL108	11/16/1999	1402	66.000	82.9%	82.9	400	6.46E+11
21FLHILL108	12/14/1999	1440	57.000	90.3%	90.3	1100	1.53E+12
21FLHILL108	1/18/2000	1410	56.000	90.9%	90.9	2500	3.43E+12
21FLHILL108	2/15/2000	1350	61.000	86.9%	86.9	3300	4.92E+12
21FLHILL108	3/14/2000	1405	47.000	95.5%	95.5	2300	2.64E+12
21FLHILL108	4/18/2000	1345	51.000	93.5%	93.5	4100	5.12E+12
21FLHILL108	5/16/2000	1445	33.000	99.2%	99.2	2000	1.61E+12
21FLHILL108	6/20/2000	1445	28.000	100.0%	100	2800	1.92E+12
21FLHILL108	7/18/2000	1500	57.000	90.3%	90.3	3900	5.44E+12
21FLHILL108	8/15/2000	1510	202.000	23.2%	23.2	5000	2.47E+13
21FLHILL108	9/19/2000	1500	224.000	20.9%	20.9	11300	6.19E+13
21FLHILL108	10/10/2000	1430	60.000	87.7%	87.7	4400	6.46E+12
21FLHILL108	11/14/2000	1405	43.000	97.0%	97	7300	7.68E+12
21FLHILL108	12/12/2000	1355	43.000	97.0%	97	5700	6.00E+12
21FLHILL108	1/16/2001	1340	42.000	97.2%	97.2	300	3.08E+11
112WRD 02303000	1/23/2001	1038	35.000	98.9%	98.9	320	2.74E+11
112WRD 02303000	2/6/2001	958	41.000	97.4%	97.4	310	3.11E+11
21FLHILL108	2/20/2001	1348	35.000	98.9%	98.9	2400	2.06E+12
21FLHILL108	3/20/2001	1325	56.000	90.9%	90.9	6800	9.32E+12
21FLTPA 24030044	3/27/2001	1110	39.000	98.2%	98.2	390	3.72E+11
21FLHILL108	4/17/2001	1444	44.000	96.7%	96.7	2700	2.91E+12
21FLHILL108	5/15/2001	1355	30.000	99.7%	99.7	2800	2.06E+12
112WRD 02303000	5/22/2001	1010	28.000	100.0%	100	340	2.33E+11
21FLHILL108	6/19/2001	1458	33.000	99.2%	99.2	3400	2.75E+12
112WRD 02303000	7/10/2001	1000	67.000	82.0%	82	390	6.39E+11
21FLHILL108	7/24/2001	1411	155.000	30.8%	30.8	7700	2.92E+13
112WRD 02303000	8/7/2001	910	422.000	10.0%	10	2000	2.06E+13
21FLHILL108	8/21/2001	1419	175.000	27.3%	27.3	4700	2.01E+13
21FLHILL108	9/18/2001	1427	2440.000	0.6%	0.6	8300	4.95E+14
21FLHILL108	10/16/2001	1405	123.000	40.6%	40.6	3100	9.33E+12
21FLHILL108	11/13/2001	1432	77.000	71.4%	71.4	3900	7.35E+12
21FLHILL108	12/11/2001	1416	74.000	74.6%	74.6	3300	5.97E+12

*Flow and concentration data were limited to the Group 2 verification period, January 1996 through December 2003. Flow data were from USGS Gage 02303000, located in WBID 1443D.

As noted previously, values on the load duration curve can be grouped by hydrologic conditions to help identify the most likely potential sources. Exceedances falling into the 10th through 40th percentile flows are typically associated with moist conditions when stormwater loads are the most likely source, and exceedances falling in the 60th through 90th percentiles are typically associated with dry conditions when point sources are likely the dominant source **(Figure 5.3).**

Table 5.2 depicts the allowable total coliform load for peak flow and for 5 percentile increments in flow. **Table 5.2** was created by taking the Nth percentile flow (flow rank in the table) from the measured flow data and multiplying this percentile flow by the 2,400 CFU/100mL criterion value after conversion into bacteria counts/day. This conversion was accomplished by multiplying the criterion by ((28317/100)*60*60*24). The factor 28317/100 converts counts/100mL into counts per cubic foot.

Table 5.2. Total Coliform Target Loads for Flow

Flow Rank	Flow Rank (%)	Cfs	Allowable Loads	
0.011%		6900.0	4.05E+14	Peak
0.100%		4086.8	2.40E+14	
0.274%		3237.5	1.90E+14	1-day
1%	1	1700.0	9.98E+13	
5%	5	698.0	4.10E+13	
10%	10	419.0	2.46E+13	
15%	15	295.5	1.74E+13	
20%	20	232.0	1.36E+13	
25%	25	188.0	1.10E+13	
30%	30	158.0	9.28E+12	
35%	35	138.0	8.10E+12	
40%	40	124.0	7.28E+12	
45%	45	118.0	6.93E+12	
50%	50	105.0	6.17E+12	
55%	55	98.0	5.75E+12	
60%	60	91.0	5.34E+12	
65%	65	84.0	4.93E+12	
70%	70	78.0	4.58E+12	
75%	75	73.0	4.29E+12	
80%	80	69.0	4.05E+12	
85%	85	63.00	3.70E+12	
90%	90	57.00	3.35E+12	
95%	95	47.50	2.79E+12	
99%	99	34.00	2.00E+12	
100%	100	27.00	1.59E+12	Low

Finally, the percent reduction in loading needed for compliance with the state criterion was calculated. This calculation involved both the allowable load and median of the measured exceedances previously computed for each zone. Using percentile increments of 5, 25, 50, 75, and 95 as the median of the zones for the allowable daily loads, the needed reduction of daily load for each zone was computed using the following formula:

$$(2)\ \frac{\text{(median exceedance)} - \text{(median allowable load)}}{\text{(median exceedance)}} \times 100$$

The TMDL is the median allowable load for the critical period (zone) or periods (zones), and the percent reduction for the zone expresses the required improvement. In this case, the critical zones were both the "Moist" zone and the combination of the "Dry/Low" zones (see **Tables 5.3** and **5.4**). While there is a high percent reduction for both "High" (~ 93 percent) and "Mid-Range" (~ 34 percent), the number of exceedances is low for these zones. **Table 5.4** shows that there was only 1 exceedance in the "Mid-Range" zone, and 2 for the "High" zone.

Table 5.3. Percent Reductions Required for Different Flow Zones

	High (0 – 10)	Moist (11 – 40)*	Mid-Range (41 – 60)	Dry and Low (61 – 100)*
TMDL (allowed load)	4.10E+13	**1.10E+13**	6.17E+12	**3.88E+12**
Existing	5.58E+14	**2.92E+13**	9.33E+12	**5.28E+12**
% Reduction	92.7	**62.3**	33.9	**26.5**

* Column entries in boldface type indicate flow zones where the majority of the exceedances occurred.

5.2.3 Critical Conditions/Seasonality

No single critical period could be determined. Based on the results shown in **Figure 5.3** and **Table 5.4,** it can be seen that there are two critical periods. The "Moist" zone (~ 23 percent of the total exceedances) and the combination of the "Dry and Low" zones (~ 63 percent of the total exceedances) contain the majority of the exceedances (86 percent).

Table 5.4. Flow Conditions under which Exceedances Occurred

Flow Condition	No. of Exceedances for Flow Condition	Percent of Exceedances over All Flow Condition	No. of Nonexceedances for Flow Condition	Percent of Nonexceedances over All Flow Condition	Total No. of Observations for Flow Condition	Percent of Total Observations for Flow Condition
High	2	9.09	5	8.33	7	8.54
Moist	5	22.73	16	26.67	21	25.61
Mid-Range	1	4.55	12	20.00	13	15.85
Dry	5	22.73	20	33.33	25	30.49
Low	9	40.91	7	11.67	16	19.51
TOTAL	**22**	**100.01**	**60**	**100.00**	**82**	**100.00**

Chapter 6: DETERMINATION OF THE TMDL

6.1 Expression and Allocation of the TMDL

The objective of a TMDL is to provide a basis for allocating acceptable loads among all of the known pollutant sources in a watershed, so that appropriate control measures can be implemented and water quality standards achieved. A TMDL is expressed as the sum of all point source loads (Waste Load Allocations, or WLAs), nonpoint source loads (Load Allocations, or LAs), and an appropriate margin of safety (MOS), which takes into account any uncertainty concerning the relationship between effluent limitations and water quality:

$$\textbf{TMDL} = \sum \textbf{WLAs} + \sum \textbf{LAs} + \textbf{MOS}$$

As discussed earlier, the WLA is broken out into separate subcategories for wastewater discharges and stormwater discharges regulated under the NPDES Program:

$$\textbf{TMDL} \cong \sum \textbf{WLAs}_{\textbf{wastewater}} + \sum \textbf{WLAs}_{\textbf{NPDES Stormwater}} + \sum \textbf{LAs} + \textbf{MOS}$$

It should be noted that the various components of the revised TMDL equation may not sum up to the value of the TMDL because (a) the WLA for NPDES stormwater is typically based on the percent reduction needed for nonpoint sources and is also accounted for within the LA, and (b) TMDL components can be expressed in different terms (for example, the WLA for stormwater is typically expressed as a percent reduction, and the WLA for wastewater is typically expressed as mass per day).

WLAs for stormwater discharges are typically expressed as a percent reduction because it is very difficult to quantify the loads from MS4s (given the numerous discharge points) and to distinguish loads from MS4s from other nonpoint sources (given the nature of stormwater transport). The permitting of stormwater discharges also differs from the permitting of most wastewater point sources. Because stormwater discharges cannot be centrally collected, monitored, and treated, they are not subject to the same types of effluent limitations as wastewater facilities, and instead are required to meet a performance standard of providing treatment to the “maximum extent practical” through the implementation of best management practices (BMPs).

This approach is consistent with federal regulations (40 CFR § 130.2[I]), which state that TMDLs can be expressed in terms of mass per time (e.g., pounds per day), toxicity, or **other appropriate measure**. The TMDL for WBID 1443D of the Hillsborough River is expressed in terms of a percent reduction, and represents the maximum daily total coliform load the river segment can assimilate and maintain the total coliform criterion **(Table 6.1).**

Table 6.1. TMDL Components for WBID 1443D of the Hillsborough River

WBID	Parameter	Zone	TMDL (colonies/day)	WLA		LA (Percent Reduction)	MOS
				Wastewater (colonies/day)	NPDES Stormwater		
1443D	Total Coliform	Moist Zone[1]	1.10E13 CFU/day	NA	62.3%	62.3%	Implicit
1443D	Total Coliform	Dry/Low Zones[2]	3.88E12 CFU/day	NA	26.5%	26.5 %	Implicit

[1] Moist Zone is that part of the Load Duration Curve starting at 124 cfs up to 419 cfs.
[2] Dry/Low Zone is that part of the Load Duration Curve starting at 27 cfs up to 91 cfs.
NA – Not applicable.

6.2 Load Allocation (LA)

Based on a load duration curve approach similar to that developed by the state of Kansas (Stiles, 2002), a total coliform reduction of 62.3 percent is needed from nonpoint sources during the "Moist" period, and a 26.5 percent reduction is needed during the "Dry/Low" period. It should be noted that the LA includes loading from stormwater discharges that are not part of the NPDES Stormwater Program (see **Appendix A**).

6.3 Wasteload Allocation (WLA)

6.3.1 NPDES Wastewater Discharges

There are no NPDES wastewater discharges in WBID 1443D.

6.3.2 NPDES Stormwater Discharges

Hillsborough County MS4 Permit Number FLS000006 must obtain a 62.3 percent reduction in total coliform during "Moist" periods and a 26.5 percent reduction during "Dry/Low" periods. Pasco County MS4 Permit Number FLS000032 must achieve a 62.3 percent reduction in total coliform during "Moist" periods and a 26.5 percent reduction during "Dry/Low" periods. It should be noted that any MS4 permittee will only be responsible for reducing the loads associated with stormwater outfalls that it owns or otherwise has responsible control over, and it is not responsible for reducing other nonpoint source loads in its jurisdiction.

6.4 Margin of Safety

Consistent with the recommendations of the Allocation Technical Advisory Committee (Florida Department of Environmental Protection, February 2001), an implicit margin of safety (MOS) was used in the development of this TMDL. An implicit MOS was provided by the conservative decisions associated with a number of modeling assumptions and the development of assimilative capacity using the load duration method, which only focuses on exceedances.

An additional MOS was included in the TMDL by not allowing any exceedances of the state criterion, even though intermittent natural exceedances of the criterion would be expected and would be taken into account when determining impairment. The implicit MOS is appropriate, as existing loads are based on in-stream coliform measurements. These measurements include decay processes occurring in-stream and do not represent the maximum load that can be applied to the land and transported to the stream during a rain event.

Chapter 7: NEXT STEPS: IMPLEMENTATION PLAN DEVELOPMENT AND BEYOND

7.1 Basin Management Action Plan

Following the adoption of this TMDL by rule, the next step in the TMDL process is to develop an implementation plan for the TMDL, which will be a component of the Basin Management Action Plan (BMAP) for the Tampa Bay Tributaries Basin. This document will be developed over the next year in cooperation with local stakeholders and will attempt to reach a consensus on more detailed allocations and on how load reductions will be accomplished. The BMAP will include the following:

- Appropriate allocations among the affected parties,
- A description of the load reduction activities to be undertaken,
- Timetables for project implementation and completion,
- Funding mechanisms that may be utilized,
- Any applicable signed agreement,
- Local ordinances defining actions to be taken or prohibited,
- Local water quality standards, permits, or load limitation agreements, and
- Monitoring and follow-up measures.

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Appendices

Appendix A: Background Information on Federal and State Stormwater Programs

In 1982, Florida became the first state in the country to implement statewide regulations to address the issue of nonpoint source pollution by requiring new development and redevelopment to treat stormwater before it is discharged. The Stormwater Rule, as authorized in Chapter 403, F.S., was established as a technology-based program that relies on the implementation of BMPs that are designed to achieve a specific level of treatment (i.e., performance standards) as set forth in Chapter 62-40, F.A.C.

The rule requires the state's water management districts (WMDs) to establish stormwater pollutant load reduction goals (PLRGs) and adopt them as part of a SWIM plan, other watershed plan, or rule. Stormwater PLRGs are a major component of the load allocation part of a TMDL. To date, stormwater PLRGs have been established for Tampa Bay, Lake Thonotosassa, the Winter Haven Chain of Lakes, the Everglades, Lake Okeechobee, and Lake Apopka. No PLRG has been developed for Newnans Lake at the time this study was conducted.

In 1987, the U.S. Congress established Section 402(p) as part of the federal Clean Water Act Reauthorization. This section of the law amended the scope of the federal NPDES stormwater permitting program to designate certain stormwater discharges as "point sources" of pollution. These stormwater discharges include certain discharges that are associated with industrial activities designated by specific Standard Industrial Classification (SIC) codes, construction sites disturbing five or more acres of land, and master drainage systems of local governments with a population above 100,000, which are better known as municipal separate storm sewer systems (MS4s). However, because the master drainage systems of most local governments in Florida are interconnected, the EPA has implemented Phase 1 of the MS4 permitting program on a countywide basis, which brings in all cities (incorporated areas), Chapter 298 urban water control districts, and the Florida Department of Transportation throughout the fifteen counties meeting the population criteria.

An important difference between the federal and state stormwater permitting programs is that the federal program covers both new and existing discharges, while the state program focuses on new discharges. Additionally, Phase 2 of the NPDES Program will expand the need for these permits to construction sites between one and five acres, and to local governments with as few as 10,000 people. These revised rules require that these additional activities obtain permits by 2003. While these urban stormwater discharges are now technically referred to as "point sources" for the purpose of regulation, they are still diffuse sources of pollution that cannot be easily collected and treated by a central treatment facility similar to other point sources of pollution, such as domestic and industrial wastewater discharges. The Department recently accepted delegation from the EPA for the stormwater part of the NPDES Program. It should be noted that most MS4 permits issued in Florida include a re-opener clause that allows permit revisions to implement TMDLs once they are formally adopted by rule.

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